VARIETY ENTERPRISES CORPORATION: CAPITAL BUDGETING DECISION

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CASE DESCRIPTION

The capital budgeting decision is one of the most important financial decisions in business firms. In this case, Variety Enterprises Corporation (VEC) is considering whether to invest in a new production system. To determine if the project is profitable, VEC must first determine the weighted average cost of capital to finance the project. The simple payback period, discounted payback period, net present value (NPV), internal rate of return (IRR), and modified internal rate of return (MIRR) techniques are used to study the profitability of the project. MIRR is a relatively new capital budgeting technique, which assumes that the reinvestment rate of the project's intermediary cash flows is the firm's cost of capital. The stand-alone risk of the project is evaluated with the sensitivity analysis and scenario analysis techniques assuming that manufacturing the new product would not affect the current market risk of the company. The case gives students an opportunity to use the theoretical profitability and risk analysis techniques explained in standard finance textbooks in a real-world setting. The case is best suited for MBA and Master of Accounting students and is expected to take approximately three to four hours to complete. The case may also be appropriate for undergraduate senior finance majors.

JEL: G31

KEYWORDS: Capital budgeting, weighted average cost of capital, cash flow, payback period, net present value, internal rate of return, modified internal rate of return, sensitivity analysis, scenario analysis

CASE INFORMATION

Variety Enterprises Corporation (VEC) is planning to invest in a special manufacturing system to produce a new product. The invoice price of the system is $280,000. It would require $5,000 in shipping expenses and $15,000 in installation costs. The system falls in MACRS 3-year class with depreciation rates of 33% for the first year, 45% for the second year and 15% for the third year. VEC plans to use the system for four years and it is expected to have a salvage value of $40,000 after four years of use.

VEC expects the new system to generate sales of 1,500 units per year. The company estimates that the new product will sell for $250 per unit in the first year with a cost of $150 per unit, excluding depreciation. Management projects that both the sale price and the cost per unit will increase by 3% per year due to inflation. VEC's net operating working capital would have to increase by 15% of sales revenues to produce the new product. The firm's marginal tax rate is 40%.

VEC's WACC

Joan Hamilton, a recent MBA graduate of Columbia University, is conducting the capital budgeting analysis for the project. The company hired her only a few weeks ago as the head of the newly formed Capital Budgeting Analysis Department. In order to evaluate the feasibility of the investment in the new

system, Joan Hamilton's first task is to estimate VEC's WACC. She plans to use the financial data in Exhibit 1 to estimate the WACC. When VEC started evaluating the project, the following conversation took place between Joan Hamilton and Benny Gray. Benny Gray, the CEO of the company, is a Princeton graduate with a major in financial economics and long years of administrative experience.

Hamilton: It may be difficult to estimate the cost of borrowing in the current recessionary environment.

Gray: We can determine the yield to maturity (YTM) on our outstanding bonds by using their current market prices. We can assume that we will be able to issue additional bonds with this YTM as the cost of borrowing. We should be able to place the new bonds without any flotation costs. Therefore, we can assume no flotation costs in our calculations. We can re-examine the feasibility of the project later before raising funds by using sensitivity analysis to assess the impact of possible changes in interest rates on the net present value of the project.

Hamilton: Do you think the company's current market value capital structure is optimal? Can we use the current percentages of the capital components as weights in the calculation of the company's WACC?

Gray: Yes, I believe that the company's current market value capital structure of 30% debt, 10% preferred stock and 60% equity is optimal. We have about $80,000 in retained earnings this year, which is also available in cash. We should be able to use this year's retained earnings to finance part of the equity financing required for the project. However, we will have to issue some new common shares for the remainder of the necessary equity financing. We can assume a flotation cost of about 10% for the new common shares.

Hamilton: There are three basic methods of calculating a firm's cost of equity when retained earnings are used as equity capital: 1) the capital asset pricing method (CAPM); 2) the discounted cash flow (DCF) approach; and, 3) the bond-yield-plus-risk-premium method. Which of these methods should we use in the calculation of our cost of retained earnings?

Gray: Although each of these methods has its merits, I believe that the most appropriate approach for our company would be to find an average cost with the three methods.

Benny Gray gave only one week to Joan Hamilton for her estimation of VEC's WACC. With the instructions she received from Benny Gray and with the help of the financial data in Exhibit 1, Joan Hamilton began the task of estimating the company's WACC immediately.

Benny Gray knew that estimating the company's cost of capital was the first critical step in the capital budgeting process. Without this analysis, it would not be possible to determine if the new system would be a profitable investment for VEC. That is why he had asked Joan Hamilton to estimate the company's WACC as the first task. Benny Gray was very pleased when he received Joan Hamilton's calculation results and the WACC estimate. He thought that he had made a good decision in hiring Joan Hamilton as the head of the company's newly established Capital Budgeting Analysis Department.

Exhibit 1: Financial data Joan Hamilton plans to use in estimating VEC's WACC

VEC's current market value optimal capital structure:

		Weight
Bonds	$30,000,000	30%
Preferred Stock	10,000,000	10%
Common Equity	60,000,000	60%

Data to be used in the calculation of the cost of borrowing with bonds:

Par value = $1,000, non-callable
Market value = $1,085.59
Coupon interest = 9%, semiannual payment
Remaining maturity = 15 years
New bonds can be privately placed without any flotation costs

Data to be used in the calculation of the cost of preferred stock:

Par value = $100
Annual dividend = 9% of par
Market value = $102
Flotation cost = 5%

Data to be used in the calculation of the cost of common equity:

CAPM data:	VEC's beta = 1.2
	The yield on T-bonds = 5%
	Market risk premium = 5%
DCF data:	Stock price = $19.08
	Last year's dividend (D_0) = $1.00
	Expected dividend growth rate = 5%
Bond-yield-plus-risk-premium:	Risk premium = 3.5%

Amount of retained earnings available = $80,000
Amount of new common stock to be issued = ($300,000) (0.6) - $80,000
= $100,000

This exhibit shows the data needed to estimate the firm's WACC. Specifically, it first presents VEC's current market value optimal capital structure used to determine the weights in the WACC calculation. It then provides the data required to calculate the cost of debt, the cost of preferred stock and the cost of common stock. The amount of new common stock to be issued is provided at the end of the exhibit.

Analysis of the Profitability of the Project

Benny Gray and Joan Hamilton had the following conversation regarding how they should evaluate the potential profitability of the project.

Hamilton: With the sales and cost estimates I have obtained from the marketing and accounting departments in Exhibit 2, we should be able to estimate the project's cash flows for the four-year horizon.

Gray: Excellent! How are we going to evaluate the project's profitability to determine if it is feasible?

Hamilton: The Net Present Value (NPV) and Internal Rate of Return (IRR) methods are generally used in the evaluation of projects. However, these two methods have different assumptions regarding the reinvestment rate of the intermediary cash flows. The NPV method assumes that the intermediary cash flows can be reinvested at the firm's cost of

capital. However, the IRR method assumes that the reinvestment rate is the project's IRR. Academicians argue that the reinvestment rate assumption of the NPV method is more realistic. Therefore, they recommend the NPV method. The financial goal of a firm is to maximize market value. The NPV of a project shows its contribution to the market value of the firm.

Gray: Correct! However, the NPV is a dollar amount. It is difficult to explain the profitability of a project as a dollar amount to the stockholders of the company. It is easier to compare the project's IRR with the firm's WACC to convince the stockholders that we can earn a higher percentage return on the investment than what it would cost to finance it. I have heard that there is a new improved capital budgeting technique that measures the profitability of a project as a percentage similar to the IRR method and it assumes that the project's intermediary cash flows can be reinvested at the firm's cost of capital as in the NPV method. I believe the technique is called the Modified Internal Rate of Return (MIRR) method.

Hamilton: No problem. We should be able to calculate the project's MIRR.

Gray: Great! I would also like to see the NPV, IRR, simple payback period, and discounted payback period results for the project.

Hamilton: Consider it done!

With the instructions she received from Benny Gray, Joan Hamilton immediately started to work on the cash flow calculations using the data in Exhibit 2 to analyze the profitability of the project with the NPV, IRR, MIRR, simple payback period, and discounted payback period methods.

Risk Analysis

After Joan Hamilton submitted the cash flow calculations and the project profitability analysis results to Benny Gray, they had the following conversation regarding the risk analysis for the project.

Gray: The NPV, IRR, MIRR, simple payback and discounted payback results all look promising. However, we should also conduct a risk analysis of the project before we go ahead with it. Since the new product will be similar to the company's other existing products, I do not believe the new project will change the company's beta and its overall market risk. Therefore, it should be sufficient to evaluate the stand- alone risk of the project. What are the techniques that we can use to assess the stand-alone risk of a project?

Hamilton: Sensitivity analysis is a widely used technique to determine how much a project's NPV will change in response to a given change in an input variable. Input variables such as sales or the cost of capital are often used while holding other things constant.

Gray: Sales figures are difficult to forecast with a high degree of accuracy. Therefore, we should conduct a sensitivity analysis with regard to possible changes in the forecasted sales figures. It should be sufficient to evaluate the impact of an increase or a decrease of 10% in sales from our base forecast. The new system will be initially employed at about 80% capacity with our base sales forecast. Therefore, the unutilized capacity of the system should enable us to accommodate a 10% increase in sales. We estimate that

costs, excluding depreciation, will be 60% of sales. We can assume that this ratio will not change with the 10% increase or decrease in sales.

Hamilton: No problem. We can conduct a sensitivity analyses for the project's NPV with regard to a 10% deviation from our base sales forecast.

Gray: Given the current volatile financial environment, the actual WACC figure is also likely to deviate from the expected base level. I would like to know how sensitive the project's NPV is to an increase or decrease of 1% in the WACC.

Hamilton: No problem. We should be able to conduct a sensitivity analysis for the project with regard to a possible 1% change in the WACC. Another analysis technique for project risk widely used in practice is scenario analysis. In this technique, the best and worst-case NPV scenarios are compared with the project's expected NPV. Do you want us to conduct a scenario analysis of the project as well?

Exhibit 2: The data Joan Hamilton plans to use in the calculation of the cash flows for the project and in the evaluation of its profitability

The Machinery's Invoice Price		$280,000
Shipping Charges		5,000
Installation Cost		15,000
Depreciable Basis		$300,000
MACRS Depreciation Rates:	Year 1	33%
	Year 2	45%
	Year 3	15%
	Year 4	7%
Salvage Value:		$40,000

Annual revenue and cost estimates (assume 3% inflation rate):

	Year 1	Year 2	Year 3	Year 4
Units	1,500	1,500	1,500	1,500
Unit Price	$250.00	_____	_____	_____
Unit Cost	150.00	_____	_____	_____
Sales	375,000	_____	_____	_____
Costs	225,000	_____	_____	_____

Net Operating Working Capital (NOWC) Requirement:

	Year 0	Year 1	Year 2	Year 3	Year 4
Sales		$375,000	_____	_____	_____
NOWC (15% of sales)	$56,250	_____	_____	_____	_____
CF due to NOWC	(56,250)	_____	_____	_____	_____

This exhibit shows the data needed to calculate the cash flows for this project. The new production system has a useful life of 4 years, a salvage value of $40,000 and falls in MACRS 3-year class. Annual revenue and cost estimates are presented in the middle of the exhibit. The system is expected to generate sales of 1,500 units per year, with a unit price of $250 and unit cost of $150. VEC's net operating working capital requirement, which is shown at the bottom of the exhibit, is 15% of total sales.

Gray: Yes. It would be a good idea. As the best-case scenario, assume that the sales forecast will be 10% higher and the WACC will be 1% lower than our original estimates. For the worst-case scenario, assume that the sales forecast will be 10% lower and the WACC will be 1% higher. Please calculate the standard deviation and the coefficient of variation of the project's NPV probability distribution with these scenarios. You can assume a probability of 50% for the base NPV forecast, a probability of 20% for the best-case scenario, and a probability of 30% for the worst-case scenario.

Hamilton: No problem. I should be able to submit the risk analysis results to you within a week.

With the instructions she received from Benny Gray, Joan Hamilton immediately started to conduct a stand-alone risk evaluation of the project with the sensitivity analysis and scenario analysis techniques.

QUESTIONS

Assume that you are Joan Hamilton. Answer the following questions:

1. Calculate VEC's WACC using the data in Exhibit 1.

2. Calculate the project's cash flows using the data in Exhibit 2. Why is it important to take into account the effect of inflation in forecasting the cash flows? Briefly comment.

3. Evaluate the profitability of the project with the NPV, IRR, MIRR, simple payback period, and discounted payback period methods. Is the project acceptable? Briefly explain. Why is the NPV method superior to the other methods of capital budgeting? Briefly explain.

4. Conduct the stand-alone risk analysis of the project with the sensitivity analysis and scenario analysis techniques. Explain why sensitivity analysis and scenario analysis can be useful tools in the capital budgeting decision-making process when economic and financial conditions are likely to change in the future.

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TEACHING NOTES

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QUESTIONS

Question 1: Calculate VEC's WACC using the data in Exhibit 1.

Solution 1: Cost of Debt: (The FV/PV charts, a financial calculator or a spreadsheet can be used in the calculation): $r_d = 8\%$

Cost of Preferred Stock:

$$r_{ps} = D_{ps} / P_{ps} (1 - F) = (0.09)(\$100) / (\$102)(1 - 0.05) = \$9 / \$96.9 = 9.3\%$$

Cost of Common Equity:

CAPM: $r_s = r_{RF} + (RP_M)\, b = 0.05 + (0.05)\,(1.2) = 11\%$

DCF: $r_s = [D_0(1 + g) / P_0] + g = [\$1(1 + 0.05) / \$19.08] + 0.05 = 10.5\%$

Own-Bond Yield-Plus-Risk Premium: $r_s = r_d + \text{Bond RP} = 0.08 + 0.035 = 11.5\%$

Cost of retained earnings (average r_s) = (11% + 10.5% + 11.5%) / 3 = 11%

Cost of new common stock = 11% / (1 - 0.1) = 12.2%

$$\text{WACC} = w_d\, r_d\, (1 - T) + w_{ps}\, r_{ps} + w_{re}\, r_s + w_{ncs}\, r_e = (0.3)(0.08)(1 - 0.4) + (0.1)(0.093) + (0.6)(80{,}000/180{,}000)(0.11) + (0.6)(100{,}000/180{,}000)(0.122) = 9.37\%$$

Question 2: Calculate the project's cash flows using the data in Exhibit 2. Why is it important to take into account the effect of inflation in forecasting the cash flows? Briefly comment.

Solution 2: Annual revenue and cost estimates (assume 3% inflation rate):

	Year 1	Year 2	Year 3	Year 4
Units	1,500	1,500	1,500	1,500
Unit Price	$250.00	$257.50	$265.23	$273.18
Unit Cost	150.00	154.50	159.14	163.91
Sales	$375,000.00	$386,250.00	$397,837.50	$409,772.63
Costs	225,000.00	231,750.00	238,702.50	245,863.58

Depreciation:

Year 1	33% x $300,000 = $99,000
Year 2	45% x $300,000 = 135,000
Year 3	15% x $300,000 = 45,000
Year 4	7% x $300,000 = 21,000

Operating cash flows:

	Year 1	Year 2	Year 3	Year 4
Sales	$375,000.00	$386,250.00	$397,837.50	$409,772.63
Costs	225,000.00	231,750.00	238,702.50	245,863.58
Depreciation	99,000.00	135,000.00	45,000.00	21,000.00
EBIT	51,000.00	19,500.00	114,135.00	142,909.05
Tax (40%)	20,400.00	7,800.00	45,654.00	57,163.62
NOPAT	30,600.00	11,700.00	68,481.00	85,745.43
Add Depreciation	99,000.00	135,000.00	45,000.00	21,000.00
Net Operating Cash Flow	$129,600.00	$146,700.00	$113,481.00	$106,745.43

Net operating working capital (NOWC) requirement:

	Year 0	Year 1	Year 2	Year 3	Year 4
Sales		$375,000.00	$386,250.00	$397,837.50	$409,772.63
NOWC (15% of sales)	$56,250.00	57,937.50	59,675.63	61,465.89	
CF due to NOWC	(56,250.00)	(1,687.50)	(1,738.13)	(1,790.27)	61,465.89

Salvage value: ($40,000.00)(1 – 0.4) = $24,000.00

Project net cash flows:

	Year 0	Year 1	Year 2	Year 3	Year 4
Initial Investment	($300,000.00)				
Operating Cash Flows		$129,600.00	$146,700.00	$113,481.00	$106,745.43
CF due to NOWC	(56,250.00)	(1,687.50)	(1,738.13)	(1,790.27)	61,465.89
Salvage Cash Flow					24,000.00
Net Cash Flows	($356,250.00)	$127,912.50	$144,961.88	$ 111,690.73	$192,211.32

The discount rate generally includes an inflation premium. If the cash flows are not adjusted for inflation, the project's NPV would be understated.

Question 3: Evaluate the profitability of the project with the NPV, IRR, MIRR, simple payback period, and discounted payback period methods. Is the project acceptable? Briefly explain. Why is the NPV method superior to the other methods of capital budgeting? Briefly explain.

Solution 3: Students can use the FV/PV charts, a financial calculator or an Excel spreadsheet in the calculation of the NPV, IRR and MIRR.

NPV = $101,598.73
IRR = 21.17%
MIRR = 16.45%

Simple Payback Period = 2.75 years
Discounted Payback Period = 3.24 years

The NPV technique is superior to the other techniques of capital budgeting. The goal of financial management is to maximize the market value of the firm. The NPV of a project shows the contribution of the project to the market value of the firm. The NPV method's reinvestment rate assumption is also more realistic compared with the IRR method.

Question 4: Conduct the stand-alone risk analysis of the project with the sensitivity analysis and scenario analysis techniques. Explain why sensitivity analysis and scenario analysis can be useful tools in the capital budgeting decision-making process when economic and financial conditions are likely to change in the future.

Solution 4: Assume that WACC is 1 percentage point higher (9.37%+1%=10.37%): (Use the same cash flows as in Question 2 and 3 above but a higher discount rate to find the project's NPV.)

NPV = $91,250.68

Assume that WACC is 1 percentage point lower (9.37%-1%=8.37%): (Use the same cash flows as in Question 2 and 3 above but a lower discount rate to find the project's NPV.)

NPV = $112,337.47

Assume that the project's sales revenues and costs (excluding depreciation) are 10% higher: (Calculate new cash flows and find the NPV of the project using the base WACC calculated in Answer 1).

Operating cash flows:

	Year 1	Year 2	Year 3	Year 4
Sales	$412,500.00	$424,875.00	$437,621.25	$450,749.89
Costs	247,500.00	254,925.00	262,572.75	270,449.93
Depreciation	99,000.00	135,000.00	45,000.00	21,000.00
EBIT	66,000.00	34,950.00	130,048.50	159,299.96
Tax (40%)	26,400.00	13,980.00	52,019.40	63,719.98
NOPAT	39,600.00	20,970.00	78,029.10	95,579.97
Add Depreciation	99,000.00	135,000.00	45,000.00	21,000.00
Net Operating Cash Flow	$138,600.00	$155,970.00	$123,029.10	$116,579.97

Net Operating Working Capital (NOWC) Requirement:

	Year 0	Year 1	Year 2	Year 3	Year 4
Sales		$412,500.00	$424,875.00	$437,621.25	$450,749.89
NOWC (15% of sales)	$61,875.00	63,731.25	65,643.19	67,612.48	
CF due to NOWC	(61,875.00)	(1,856.25)	(1,911.94)	(1,969.30)	67,612.48

Project net cash flows:

	Year 0	Year 1	Year 2	Year 3	Year 4
Initial Investment	($300,000.00)				
Operating Cash Flows		$138,600.00	$155,970.00	$123,029.10	$116,579.97
CF due to NOWC	(61,875.00)	(1,856.25)	(1,911.94)	(1,969.30)	67,612.48
Salvage Cash Flow					24,000.00
Net Cash Flows	($361,875.00)	$136,743.75	$154,058.06	$121,059.80	$208,192.46

NPV @ 9.37% = $129,983.23

Now, assume that the project's sales revenues and costs (excluding depreciation) are 10% lower: (Calculate new cash flows and find the project NPV using the base WACC calculated in Answer 1.)

Operating cash flows:

	Year 1	Year 2	Year 3	Year 4
Sales	$337,500.00	$347,625.00	$358,053.75	$368,795.36
Costs	202,500.00	208,575.00	214,832.25	221,277.22
Depreciation	99,000.00	135,000.00	45,000.00	21,000.00
EBIT	36,000.00	4,050.00	98,221.50	126,518.15
Tax (40%)	14,400.00	1,620.00	39,288.60	50,607.26
NOPAT	21,600.00	2,430.00	58,932.90	75,910.89
Add Depreciation	99,000.00	135,000.00	45,000.00	21,000.00
Net Operating Cash Flow	$120,600.00	$137,430.00	$103,932.90	$96,910.89

Net Operating Working Capital (NOWC) Requirement:

	Year 0	Year 1	Year 2	Year 3	Year 4
Sales		$337,500.00	$347,625.00	$358,053.75	$368,795.36
NOWC (15% of sales)	$50,625.00	52,143.75	53,708.06	55,319.30	
CF due to NOWC	(50,625.00)	(1,518.75)	(1,564.31)	(1,611.24)	55,319.30

Project net cash flows:

	Year 0	Year 1	Year 2	Year 3	Year 4
Initial Investment	($300,000.00)				
Operating Cash Flows		$120,600.00	$137,430.00	$103,932.90	$96,910.89
CF due to NOWC	(50,625.00)	(1,518.75)	(1,564.31)	(1,611.24)	55,319.30
Salvage Cash Flow					24,000.00
Net Cash Flows	($350,625.00)	$119,081.25	$135,865.69	$102,321.66	$176,230.19

NPV @ 9.37% = $73,214.23

Best-Case Scenario: Sales revenues and costs (excluding depreciation) are 10% higher, and WACC is 1 percentage point lower. (Student uses the cash flows calculated above with 10% higher revenues, 10% higher costs, and discounts these cash flows to the present by using 9.37%-1%=8.37% discount rate (new WACC):

	Year 0	Year 1	Year 2	Year 3	Year 4
Cash Flows:	($361,875.00)	$136,743.75	$154,058.06	$121,059.80	$208,192.46

NPV @ 8.37% = $141,555.55

Worst-Case Scenario: Sales revenues and costs (excluding depreciation) are 10% lower, and WACC is 1 percentage point higher. (Student uses the cash flows calculated above with 10% lower revenues, 10% lower costs, and discounts these cash flows to the present by using 9.37%+1%=10.37% discount rate (new WACC):

	Year 0	Year 1	Year 2	Year 3	Year 4
Cash Flows:	($350,625.00)	$119,081.25	$135,865.69	$102,321.66	$176,230.19

NPV @ 10.37% = $63,668.73

E (NPV) = (0.3)($63,668.73) + (0.5)($101,598.73) + (0.2)($141,555.55) = $98,211.09

$$\sigma_{NPV} = [(\$63,668.73 - \$98,211.09)^2 (0.3) + (\$101,598.73 - \$98,211.09)^2 (0.5) + (\$141,555.55 - \$98,211.09)^2 (0.2)]^{1/2}$$
$$= \$27, 192.63$$

$$CV_{NPV} = \$98,211.09/\$27, 192.63 = 3.61$$

Sensitivity analysis and scenario analysis can be useful tools in the capital budgeting decision-making process when economic and financial conditions are likely to change in the future.

BIOGRAPHY

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